Brining Beans With Baking Soda: An Investigation

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Soaking beans in a solution of salt and baking soda yields creamy, cooked beans in less time.

By

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Published Feb. 02, 2022

There’s a whole wide world of beans out there, from broad and flat fava beans to small, curvaceous pintos. The variation in beans is obvious in both their many shapes and in their many colors, but it's also apparent in the fact that different kinds of beans require different cooking times and preparation methods. Some beans cook up more quickly, becoming tender and creamy in a relatively short amount of time, whereas others take ages and ages to cook and may benefit from a soak in water beforehand.

In this article, I’m going to focus on questions I've long had about soaking beans in a brine before cooking, and how altering that brine can affect the cooking time and quality of the final cooked beans. Specifically, I was interested in how adding baking soda to the brine for beans would affect their cooked texture and cooking time.

Pectin: Or, Why Dried Beans Soften as They Cook

All plant cells contain pectin, which is a crucial part of the lamella, the cement or glue that holds the cells together. Pectin, along with other carbohydrates like cellulose, hemicellulose, and lignin, helps the plant cells maintain their physical structure, and these indigestible carbohydrates are what we mean when we refer to "dietary fiber." The firmness that characterizes vegetables like potatoes and African yams is directly related to the presence of large quantities of pectin.

Transforming a hard, dried bean into one that's tender, creamy, and enjoyable to eat requires first that the bean absorbs water and then, as it's heated, the bean's physical structure needs

to change. The bean's seed coat presents an initial obstacle; the water must first penetrate the seed coat before the interior of the bean can begin to absorb water and cook. This is why hulled beans, like urad dal, can be cooked in much less time; I've seen reports that removing that seed coat can reduce the cooking time of beans by up to 40%.

Once water is able to penetrate the seed coat and heat is applied, the pectin that sits inside begins to transform. As the pectin heats up it transforms from a hard, insoluble substance that holds the cells together into a soft, water-soluble material. As that pectin sitting between the cells softens and dissolves in water, the cells begin to fall apart, and that loss in structural integrity is what makes cooked beans soft and creamy.

Why Some Beans Are Hard, and Stay Hard

Debbie Wee
But everyone's cooked beans and found some that seemingly refuse to become soft. There are a couple of reasons for this phenomenon. Bean hardness is a hot topic in bean science, specifically the phenomenon of H.T.C. beans. Many bean scientists classify beans as either easy-to-cook (E.T.C.) or hard-to-cook (H.T.C.). H.T.C. beans don't soften even after cooking because their pectin remains insoluble (although their starches also fail to gelatinize properly). H.T.C. beans are often the result of long storage times and/or storage in conditions of high humidity or temperature. However, if you brine H.T.C. beans before cooking them, they will cook faster and have a better final texture, and, in addition, they will have greater nutrient availability.

The hardening of the bean pectin takes place primarily because of two enzymatic reactions. An enzyme called phytase releases calcium and magnesium ions from the lamella, and these ions quickly encounter and attach to pectin molecules, which ends up strengthening the pectin. A second enzyme, called pectin esterase, will modify the pectin, too, making it even more resistant to being dissolved. The chemistry of pectin is quite complex, but for our purposes, the first enzymatic reaction is the one I want to focus on.

Since calcium and magnesium are partially responsible for hardening the pectin in beans, I reasoned that if there was a way to pop them out, I could destabilize the pectin and thereby the integrity of the bean, making it softer and fully tender with a shorter cooking time. And, of course, the reason why I focused on this element of bean hardness is that there's a simple way to remove those ions from the pectin.

If you've cleaned tarnished silver or copper utensils, you know that you can make them shiny all over again simply by dropping them into a pot of water mixed with salt and baking soda. The way this works is that, over time, silver and copper utensils become oxidized and develop a patina as the metal reacts with chemicals present in the air. When the tarnished utensils are treated with salt and baking soda, the sodium ions present in the solution displaces the silver in the tarnish and restores the metal back to its original state, and the utensil becomes shiny again. This reaction is called a displacement reaction.

The sodium present in salt (sodium chloride) and baking soda (sodium bicarbonate) will perform a similar displacement reaction with any calcium and magnesium ions present in a bean's pectin. As soon as they come into contact, the sodium takes the place of calcium and magnesium, and the pectin consequently becomes more soluble.

Therefore, prior to cooking, beans can be soaked in brine made of either salt or baking soda. In addition, depending on the texture desired in a dish, beans can be either boiled in a pot of salted water or water to which a bit of baking soda has been added. The brine provides an environment where the sodium is in excess and helps push this transformation forward.

Testing Brining Solutions for Beans

To test the hypothesis that sodium affects pectin and consequently bean hardness and cooking, I ran a few brining experiments with different types of sodium salts. To see how different beans perform under these different conditions, I restricted myself to black beans and kidney beans. Black beans really don't need to be brined before cooking, since they have thin skins and cook easily, but I thought they'd offer a useful comparison for the kidney beans and how well they performed in the experiment.

The Experimental Setup

To evaluate the beans, I set up three groups for each type: Water, Salted Water (15g in 1 L), and Baking Soda (5g in 1 L). The amount of salt used in these experiments comes from Kenji's previous work on Serious Eats and the baking soda from a research paper published in *Food Research International*. To see how beans performed in a brine with a combination of baking soda and salt, I added one more group to the experiment, a salt and baking soda brine (15g salt with 5g baking soda in 1L of water).

To monitor how the beans performed, I measured the total dry weights of the beans and then both their raw and cooked wet weights after 24 hours. To give each bean a fair chance of starting out under similar conditions, I removed any beans that displayed any cracks or damage to their skins. To avoid any interference from salts that might be present in tap water (hard water contains a lot of calcium and magnesium, although, given the amount of sodium in the brines, the effect should have been negligible), I used filtered water in the brines. The beans were soaked at room temperature.

Both raw and cooked beans were rinsed gently with water and left to sit on dry pieces of absorbent paper towels for one minute before they were weighed to remove any excess water and get a more consistent measure.

The soaked beans were rinsed to remove any traces of the salts and then cooked in plain filtered water until tender. The endpoint for cooking beans was subjective; I determined the bean doneness by pressing them to see if they were tender all the way through.

The Results

Based on the changes in weight in both uncooked and cooked black bean samples, the baking soda brine appeared to do a much better job than the brines without baking soda.

Kidney beans appeared to be affected a bit differently by the brines when compared with the black bean trials, although just like black beans, they seem to brine nicely in baking soda, and a combination of salt and baking soda gives a much better result in terms of weight gain.

The ideal way to determine and compare the cooking time would be to pull out the beans when they reach a certain endpoint determined either by texture or time. However, both are a bit tricky to determine in my home kitchen. I relied instead on my judgment to determine when the beans were tender enough to be easily split by a knife without applying excess pressure.

The salt and baking soda brine gave the best results for both kinds of beans. The average cooking time for the black beans was 30 minutes; the average for the kidney beans was nearly 40 minutes. Of course, since these are subjective measurements and were based on my opinion of what I think is the right cooked texture for beans, take these findings with a grain of salt (no pun intended).

Effect of Sodium Brines on Beans

	Raw Beans	**Cooked Beans**	**Cooked Beans**

Effect of Sodium Brines on Beans

Black Beans	% Total Weight Increase	% Total Weight Increase	Texture (Degree of Creaminess)
Water	145.20	150.72	+
Salt	137.51	158.05	++
Baking Soda	142.61	161.72	+++
Salt + Baking Soda	107.72	108.60	++++

Kidney Beans	% Total Weight Increase	% Total Weight Increase	Texture (Degree of Creaminess)
Water	133.58	127.60	+
Salt	122.52	113.16	++
Baking Soda	130.17	117.11	+++
Salt + Baking Soda	160.08	117.46	++++

Weight changes in both the total quantity of beans soaked was measured and compared to the starting dry weight of the beans. Subjective observations on texture were also reported.

Beans soaked in salt or baking soda brines performed much better in comparison to those soaked in just water. Beans brined in baking soda performed even better than those in the salt brine. This was true across the board regardless of the type of the bean. When it came to differences in the cooking time, black beans cooked faster than kidney beans, as expected. When I asked a few folks to report on the differences in texture, the beans brined in salt or baking soda were said to be creamier than those soaked in plain water, and beans that were soaked in baking soda were described as having a smoother, creamier texture than those brined in salted water.

Now, if you take a closer look at the numbers for the kidney beans, you will notice that the percentage of total weight gained seems to be a smaller number after cooking. Compare this same observation to black beans and you'll now start to see how these beans are so different from each other, black beans increase their weight on cooking.

The explanation for this discrepancy is, I think, relatively straightforward. Dried beans absorb water during brining and, consequently, they gain weight, which you can see in the results. However, as they cook in water, the beans will continue to expand, but they will also start to leach out some of those carbohydrates–starches, pectin, etc.–into the cooking water, so some degree of weight loss is also to be expected. Based on my results, it appears that kidney beans lose weight due to the increased solubilization of these various substances, which would track with other, more formal analyses that confirm how salt solutions solubilize pectin and minerals present inside beans (like this one).

Should You Brine Your Beans?

Debbie Wee
Clearly, using a brining solution with an excess amount of sodium produce by adding both salt and baking soda produced the best results in texture, and reduced the cooking time significantly for both black and kidney beans. For kidney beans and other hard-to-cook beans, I strongly recommend brining them in a salt and baking soda solution. Would I brine my black beans in the future? My answer honestly depends on time. If I were a better planner and wanted to cook my black beans the next day, I'd probably resort to brining them, but if I wanted to cook them the day of, then I won't.

One of the quicker ways to cook beans that I haven't addressed in this article is by applying high pressure using pressure cookers. I grew up in India, where pressure cookers are the workhorse of many kitchens. High pressure and brining both reduce cooking time and improve the texture of the beans. If you decide to brine your beans and pressure cook them, I'd recommend reducing the soaking time or cutting back on the amount of salt and baking soda or they will turn extremely mushy (unless that's the texture you want).

Still aren't convinced? Check out my recipe for braised pork and beans, which uses my findings from this experiment to produce fork-tender pork and some of the creamiest beans I've ever had.